Compliance Measurement Guidance for Wireless Broadband Services Operating in the 3650–3700 MHz Band

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Background

In 2005, the FCC released a Report and Order (FCC 05-56) that adopted rules to provide for nationwide, non-exclusive licensing of wireless broadband terrestrial operations, utilizing technology with a contention-based protocol, in the 3650-3700 MHz band. The Commission established technical rules that are codified in Subpart Z of the Part 90 rules for Private Land Mobile Radio Service. This document provides a procedure for measuring the fundamental output power of these transmitting devices for the purpose of demonstrating compliance to the technical requirements specified in this rule part.

Output Power Limits

Section 90.1321(a) limits the output power spectral density for base and fixed stations to a peak (maximum average over the burst duration) Equivalent Isotropic Radiated Power (EIRP) level of 25 watts/25 MHz (44 dBm/25 MHz). Additionally, an EIRP limit of 1 watt/MHz (30 dBm/MHz) applies to accommodate various operational bandwidths.

Similarly, **Section 90.1321(c)** limits the output power spectral density for mobile and portable stations to an EIRP level of 1 watt/25 MHz (30 dBm/25 MHz), not to exceed 40 mW in any 1 MHz (16 dBm/MHz).

The procedure presented herein assumes the use of a modern spectrum or signal analyzer with digital signal processing (DSP) analysis capabilities. It is recognized that alternatives exist for performing these measurements, such as the use of built-in spectrum analysis functions and/or waveform-specific measurement personalities. Such alternative procedures are acceptable provided that they produce a measured output power that can be correlated to results obtained with an average power meter.

The device under test (DUT) must be configured to transmit continuously at maximum power over the measurement duration. This may require a special test mode or coordination with the manufacturer/applicant to configure the DUT to transmit in an operational mode that realizes the maximum output power over the burst duration or time slot allocation.

Since this procedure utilizes a conducted measurement it does not directly result in EIRP levels for comparison to the output power limits. In order to determine the EIRP level, the effective antenna gain must be added to the corrected (for external test set-up factors) measurement result. The rule section allows for the use of smart antenna technologies such as multiple-input multiple-output (MIMO). **Section 90.1321(b)** provides details regarding how to determine the effective antenna gain for these smart antenna technologies.

Band Power Measurement

1. Connect the DUT transmitter output to the spectrum analyzer via coaxial cable (*i.e.*, conducted measurement) while ensuring proper impedance matching.[1]
2. Tune the analyzer to the nominal center frequency of the emission bandwidth (EBW).[2]
3. Set the span to twice the nominal EBW (span = 2 x EBW).
4. Set the resolution bandwidth (RBW) to approximately 1% of EBW.
5. Set the video bandwidth (VBW) to ≥ 3 x RBW.
6. Select the average power (RMS) display detector.[3,4]
7. Set the number of measurement points to ≥ 1001.
8. Use auto-coupled sweep time.
9. Perform measurement over an interval of time when the transmission is continuous and at its maximum power level.[5]
10. Utilize trace averaging over 100 traces in the power averaging (*i.e.*, RMS) mode.
11. Use the Band/Channel Power function to determine the integrated power over the full EBW.
12. Record the band power level.
13. Adjust the recorded level by applying appropriate correction factors for the measurement set-up (*e.g.*, antenna gain, cable losses, pre-amplifier gain, external attenuation, etc.).
14. Determine the EIRP by adding the effective antenna gain to the adjusted power level.

Power Density Measurement

1. Connect the transmitter to the spectrum analyzer via coaxial cable (*i.e.*, conducted measurement) while ensuring proper impedance matching.[6]
2. Tune the analyzer to the nominal center frequency of the emission bandwidth (EBW).
3. Set the span to twice the nominal EBW (span = 2 x EBW).
4. Set the resolution bandwidth (RBW) to 1 MHz.
5. Set the video bandwidth (VBW) to ≥ 3 x RBW.
6. Select the average power (RMS) display detector.[7]
7. Set the number of measurement points to ≥ 1001.
8. Use auto-coupled sweep time.
9. Perform the measurement over an interval of time when the transmission is continuous and at its maximum power level.[8]

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[1] External/internal attenuation may be required to protect the analyzer front-end.
[2] EBW measured relative to the -26 dB points.
[3] Refers to a true RMS rather than a weighted RMS detector such as the CISPR-RMS dectector.
[4] An RMS detector is preferred but use of a Sample detector is acceptable.
[5] The digital data sequence(s) over which the power is measured shall be representative of those encountered during normal system operation.
[6] Note: External/internal attenuation may be required to protect the analyzer front-end when measuring base station power levels.
[7] An RMS detector is preferred but use of a Sample detector is acceptable.

10. Utilize trace averaging over 100 traces in the power averaging (*i.e.*, RMS) mode.
11. Find the maximum trace amplitude (peak search) and record.
12. Adjust the recorded level by applying appropriate correction factors for the measurement set-up (*e.g.*, antenna gain, cable losses, pre-amplifier gain, external attenuation, etc.).
13. Determine the EIRP by adding the effective antenna gain to the adjusted power level.

[8] The digital data sequence(s) over which the power is measured shall be representative of those encountered during normal system operation.